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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,318	12/11/2003	Armen Kroyan	SYN003 US	1366

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT PAPER NUMBER

1756

DATE MAILED: 09/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/734,318

Applicant(s)

KROYAN, ARMEN

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 25 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 and 23-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 23-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### Detailed Action

In response to the Amendment of 7/25/06, wherein claims 23-29 were added, the examiner withdraws the previous office action rejections and includes a new rejection here over newly cited art.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 is rejected under 35 U.S.C. 102(e) as being clearly anticipated by Pierrat (6,821,689).

Pierrat teaches the invention as claimed (see claims).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pierrat (6,821,689) in view of Tsudaka (5,825,647) and Cote et al. (6,787,271).

The claimed invention is directed to a method for generating a complementary mask data for use in a photolithographic process, the method comprising: receiving a first mask data corresponding to the complementary mask; identifying a plurality of critical openings in the first mask data; determining a threshold intensity for the plurality of critical openings during the photolithographic process; modifying the plurality of critical openings such that each of the plurality of critical openings will provide at least the threshold intensity during the photolithographic process.

And wherein modifying comprises: increasing the area of at least one cut, and the increase in area is proportional to the difference between: a maximum intensity of the opening prior to increasing and said threshold intensity.

The applicant discusses the limitations of the prior art in that when substantially all features in a layout for a layer of material in an integrated circuit are defined using a phase shifting mask, the related complementary mask that is normally used to define the remaining features and edges can be improved if intensities in an aerial image from openings on the complementary mask that are below threshold are increased to ensure that each opening meets or exceeds threshold. Such increase of intensities improves effectiveness of critical openings that are otherwise too small to print.

Absent intensity increase, such openings could limit the application of optical lithography using phase shifting masks to ever shrinking technologies. The

intensities are increased in some embodiments by enlarging some openings in the complementary mask in directions not constrained by features to be formed in an integrated circuit (by use of the phase shifting mask).

Pierrat teach the claimed method for using an exposure through a second mask to assist an exposure through a phase shifting mask, wherein the exposure through the second mask assists in exposing the space between the first feature and the second feature so that the space prints reliably.

And wherein the second mask includes an opening located over the space to assist in exposing the space on the photoresist layer.

And wherein the second mask additionally includes one or more assist features, which are not located over the space, yet assist in printing the space.

And wherein the opening in the second mask can be sub-resolution.

And wherein if the second feature is a critical dimension feature, the opening in the second mask is offset from the second feature, so that alignment problems between the phase shifting mask and the second mask do not affect printing of the critical dimension feature.

The teachings of Pierrat differ from those of the applicant in that the applicant teaches increasing the area of at least one opening in the plurality of critical openings, and that at least one opening in the complementary mask is defined by a group of edges in the pattern.

Tsudaka teaches (see claims 1-11) a method for correcting a mask pattern in which the mask pattern of a photomask to be used in a photolithographic step is deformed so that a transfer image near a desired design pattern is obtained, comprising the steps of: arranging a plurality of evaluation points along an outer periphery of the desired design pattern;

simulating the transfer image to be obtained where exposure is carried out under predetermined transfer conditions by using a photomask of the design pattern based on the evaluation points;

comparing a difference between the simulated transfer image and the design pattern for every evaluation point; and

deforming the design pattern according to the difference compared for every evaluation point so that the difference becomes smaller.

And wherein in the simulation step, two-dimensional light intensities on a substrate are calculated based on the design pattern and exposure conditions;

effects of the light intensities at a plurality of peripheral positions on exposure energy at an arbitrary position are calculated and cumulatively added based on the light intensities at the peripheral positions of that arbitrary position on the two-dimensional plane of the substrate and the distance between that particular position and the peripheral positions, whereby a latent image formation intensity at that arbitrary position is calculated on the two-dimensional plane of the

substrate; and further comprising the steps of: finding a distribution of the latent image formation intensities on the two-dimensional plane of the substrate;

determining a threshold value of the latent image formation intensity corresponding to the amount of exposure and development conditions;

finding contour lines at the threshold value for the distribution of the latent image formation intensities; and calculating the pattern defined by the contour lines as a transfer image.

And wherein target points are set corresponding to evaluation points positioned at convex corners or concave corners of the design pattern, the target points are determined inside the corner at the convex corners, and the target points are determined outside the corner at the concave corners.

Cote et al. teach (col. 16, line 51+) that some additional post processing may be required and/or desirable for compliance of the layouts with design and mask manufacturing rules. For example, turning to the layouts of FIG. 37 and FIG. 38, there is an extremely short edge in both the shifter and trim layers adjacent to the region of the cut 3510 (see FIG. 35). This edge may be removed by extending the width of the trim and shifter along the edge perpendicular to that short edge to eliminate the short edge, shown only on trim layer in FIG. 38 as a dashed line for post processed edge 3820.

It would have been obvious to one having ordinary skill in the art to take the teachings of Pierrat and combine them with the teachings Tsudaka and Cote et al. in order to make the claimed invention because it would have been obvious to one to adjust the size and configuration of the openings in the second mask while respecting the importance of critical feature edges in order to make the claimed invention, as one would know that the

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edges are the most sensitive features with respect to pattern formation limitations of diffraction of transmitted light and optical proximity.

*Conclusion*

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, cursive script.

S. Rosasco  
Primary Examiner  
Art Unit 1756

S. Rosasco  
8/25/06